A Planet without Farmers?

Food Production, Inclusive Development and Ecology: Historical Evidences for a New Deal

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❶ Ecology *vs.* Poverty?

There is an apparent disagreement between:

- the "ecological critique" that accuses "modern agriculture" of jeopardizing many ecological services through monocultures and the overuse of freshwater, fossil energy and other industrial inputs such as chemical fertilizers and pesticides
- the "techno-productivist approach" that led economists to recommend, after the 2007-08 food crisis, to "revitalize agricultural R&D investments" (Alston et al., 2009) so that agriculture plays "its role as an engine of growth" (FAO, 2009).

This poster provides materials to discuss the direction of future R&D efforts.

❷ The structural transformation

The direction of the effort could rest on the "structural transformation" paradigm that dominated development economics after World War II (Chenery & Srinivasan, 1988).

This paradigm is anchored in historical experiences of "modern economic growth" (Kuznets, 1966) and dual-economy theories of interrelated structural changes between the "traditional" (agriculture) and "modern" (non-agriculture) sectors (Lewis, 1954).

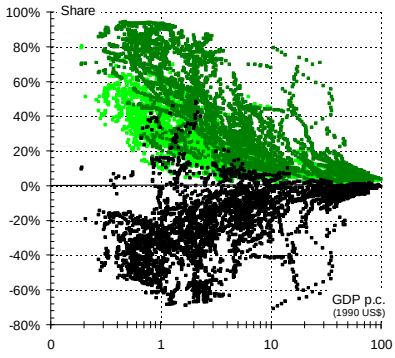
In these models, high-yielding agriculture provides low-cost food and labour to the process of industrialization and urbanization which, in turn, raises labour productivity and wages of remaining farmers until a "world without agriculture" (Timmer, 2009) with a 2-3% share of agriculture in GDP & workforce.

The figure shows:

(x-axis) total value-added per capita (GDP p.c. in 1990-US$ / day) of all countries from 1970 to 2007

and (y-axis) the respective:

- share of agriculture in total value-added (*S1*)
- share of agriculture in total employment (*S2*)
- *S1 – S2* (Timmer, 2009).



❸ A silent bifurcation

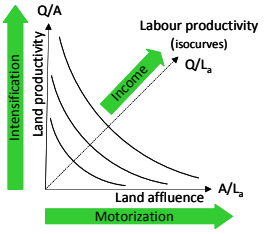
There is a growing gap between farmers who can expand their land and use motorized machineries to increase their labour productivity (incomes), and those who can't.

Farm labour productivity can be increased through:

- "Intensification" (with irrigation, fertilizers, HYV, pesticides, etc.) to get higher yields per hectare
- "Motorization" (with tractors, combine harvesters, aeroplanes, etc.) to crop more land per farmer.

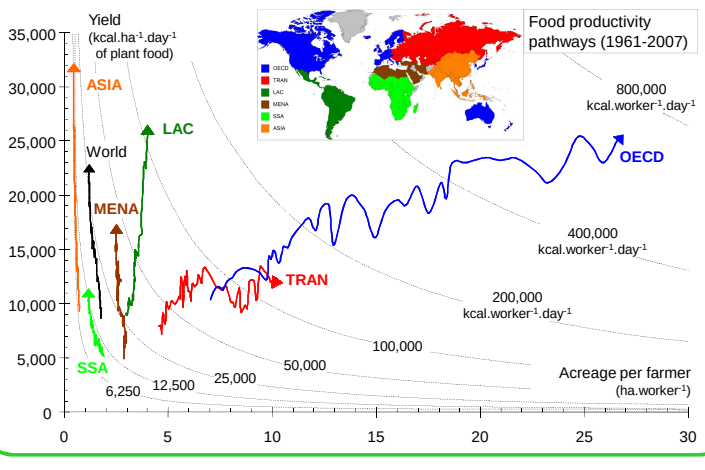
The TALA identity: $Q / A \bullet A / L_a = Q / L_a$

Technology (yield) · Affluence (of land) · Labour productivity



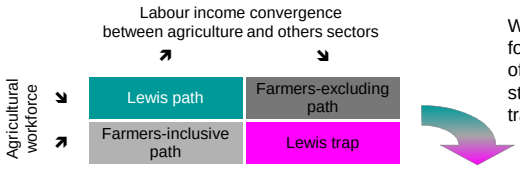
A novel consolidation of existing data: from FAO (2010), we converted & aggregated in kilocalories (kcal) all plant food harvested during a year (one crop or more), in almost all countries of the world and over a 47-year period (1961-2007).

We show that levels and growths of labour productivity (kcal/worker) are strongly driven par motorization (ha/farmer), not by yields (kcal/ha).



❹ Lewis path *vs.* Lewis trap

Only OECD and transition countries followed a "Lewis path" leading to a "world without agriculture", while the greater part of humanity is falling into a "Lewis trap".



We identified four pathways of agricultural structural transformation

1970-2007 average annual growth rates	Population (heads) Total	Workforce (workers) Total	Workforce (workers) Agriculture	Economic growth (1990-US$) Total	Economic growth (1990-US$) Agriculture	Labour productivity (1990-US$) Total	Labour productivity (1990-US$) Agriculture	Income convergence *S1 / S2*
OECD	0.69%	1.11%	–2.93%	2.81%	1.40%	1.68%	4.46%	2.75%
TRAN	0.38%	0.38%	–1.96%	1.91%	1.07%	1.50%	3.07%	1.67%
LAC	1.89%	2.92%	0.30%	3.50%	3.03%	0.56%	2.73%	2.21%
MENA	2.44%	3.00%	0.67%	4.10%	3.07%	1.08%	2.40%	1.36%
SSA	2.75%	2.80%	2.05%	3.28%	3.09%	0.46%	1.01%	0.55%
ASIA	1.75%	2.14%	1.40%	6.76%	3.69%	4.53%	2.27%	–2.16%
- South	2.13%	2.28%	1.49%	5.17%	2.76%	2.82%	1.26%	–1.56%
- East	1.49%	2.07%	1.35%	7.61%	4.38%	5.44%	3.00%	–2.31%
World	1.61%	1.95%	1.18%	3.10%	2.25%	1.13%	1.06%	–0.07%

To follow a "Lewis path", labour productivity in agriculture must grow faster than in other sectors and faster than the food demand.

Otherwise, when the absorption of labour from other sectors is insufficient to allow per farmer land acreage to increase and motorization to develop:

- urban poverty grows fast as in North Africa
- poverty is trapped in rural areas as in Asia.

The "Lewis trap" is also an "ecological trap": in the current system of prices and incentives, when land acreage per farmer can't increase, farmers have no other choice but to overexploit natural resources (soil, water…) (Dorin, 2009).

❺ Towards a new deal?

We need a paradigm shift.

A "world without agriculture"

in populous developing countries

- is not possible without mass-migration and mega-urbanization
- is costly: food & social safety nets for poor urban dwellers
- won't solve the huge asymmetry with large-scale motorized agricultures (our "Lewis path" scenario for India: ≈ 5 ha/farmer in 2050 with 1.3 billion city-dwellers).

in industrialized countries

- is costly: the "protection problem" of high-income economies (T. Shultz, 1953)
- is less competitive: few agro-food complexes with oligopolistic positions
- is less efficient: agriculture is normally subject to diseconomies of scale (Binswanger et al., 2010; Wiggins et al., 2010)
- is less resilient to economic & climatic shocks: productions are concentrated on few products in few regions.

R&D policies should help to increase production (Q) and farmers' wealth (θ_a) without downsizing in large proportions their number (L_a):

$$\theta_a = (pQ - Y_{na}^a) / L_a$$

In this labour-intensive agriculture, some agricultural inputs from the non-agricultural sector (Y_{na}^a) are saved for economic and ecological reasons, while prices paid to producers (p) are increased with the co-delivery of ecological and social services.

A 2050 vision: science & farmers managing a mosaic of agro-ecosystems boosting local synergies amongst many plant and animal species above & below ground.

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